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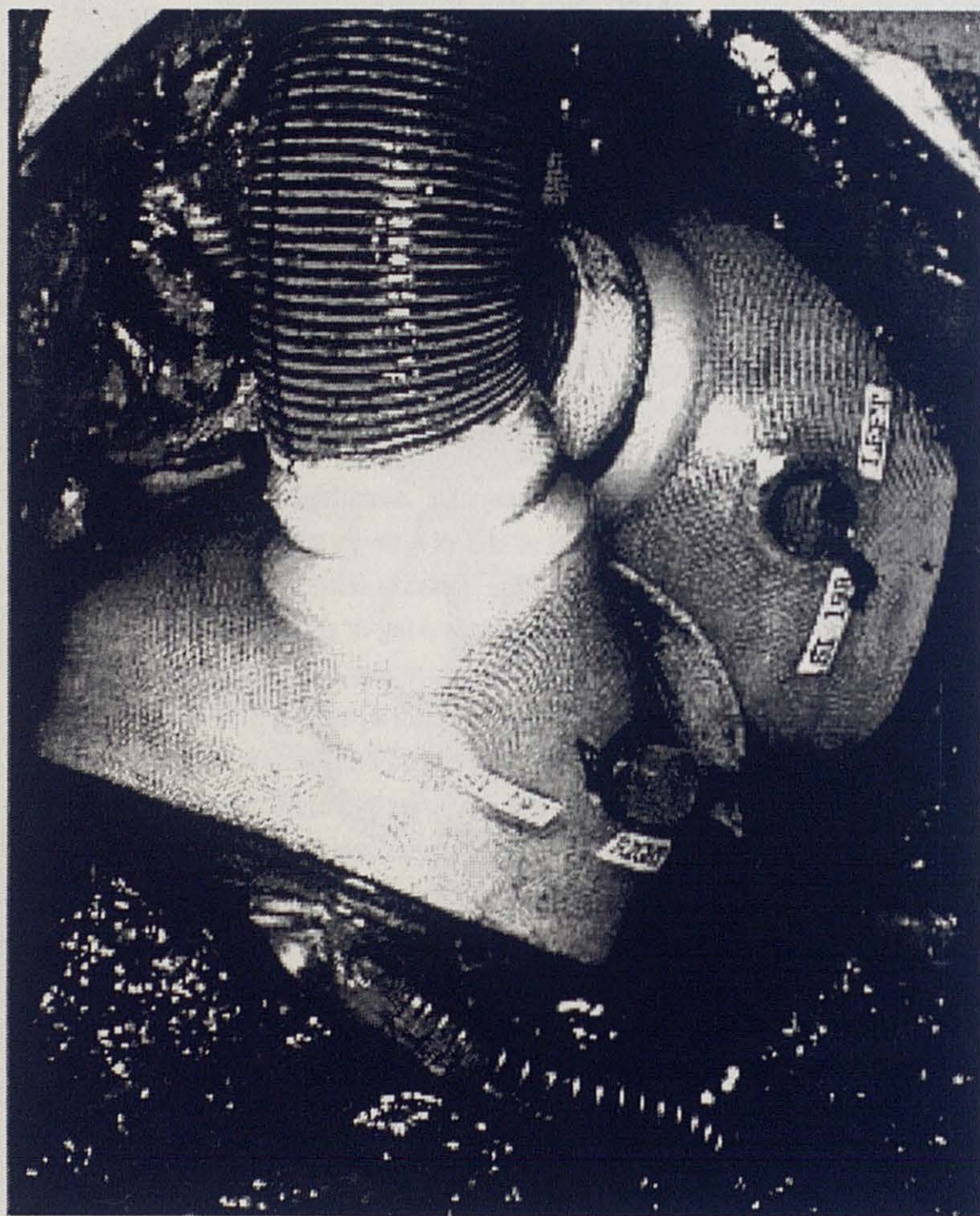
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Plastic Heart, Black Box, Iron Cage: Instrumental Reason and the Artificial Heart Experiment*

by Thomas Strong

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The heart has reasons which reason knows not.
Pascal

On the night of December 1, 1982, a surgical team in Salt Lake City implanted a plastic pump in the chest of 61 year old Barney Clark. The operation lasted nine hours; it was not without complications. It was the first time in history that a human being had been implanted with an "artificial heart" intended as a permanent replacement for his "real" heart. Clark died 112 days later on the night of March 23, 1983: his circulatory system had collapsed. Now, over a decade later, research on the artificial heart has also collapsed.

If the attention of the popular press can serve as an indicator, the story of Barney Clark and "the Jarvik-7 artificial heart," as the plastic pump was called, was a major event of the 1980s, both in the United States and internationally. Hundreds of journalists descended on Salt Lake City from around the country and around the world. Reports were registered almost daily as the staff at the University of Utah Medical Center kept the public informed of the patient's condition through routine press conferences. Images of Barney Clark proliferated throughout the media in the form of pictures and verbal descriptions of his condition:

He is permanently tethered to 375 lbs. of equipment that includes two compressors, a back-up compressor, a three-hour supply of pressurized air to operate the heart in case of a power failure, a drier to dehumidify the air, and mechanisms that control the air pressure and heart rate. All of this gear can be placed on what his doctors call a "shopping cart,"

* I want to thank Emily Martin, Vincanne Adams, Ali Demos, and Ari Shapiro for their helpful comments and criticisms.

which must always be within six feet of the patient, the length of the power lines that emerge from just below Clark's rib cage.¹

What could this mean, this image of a man with plastic tubes stuck into his body, compressing air into a plastic pump implanted in his chest cavity? Where did this cyborg come from? What are we to make of him? And why did the experiment ultimately fail? These questions motivate public and scholarly interest in the artificial heart experiment. The answers to them are complex because the heart is a polyvalent symbol. The human heart has stood for, among other things, individuality and personhood, understanding and intellect, passion and romantic love, kinship and sociality, fallibility and eternal life.² It has been the interface between mind and body, an icon of embodiment in the face of Cartesian dualism. It is, was, might continue to be, the seat of life itself.

The artificial heart experiment, if it did nothing else, placed all that in question. In this essay I want to examine the acculturation of a technoscientific experiment, believing with Paul Rabinow "...that it is not quite true, as is so often asserted, that it is the 'newness' of contemporary technology that leaves us culturally unprepared. It is also the effacement of the 'oldness' of so many of the background assumptions and practices that lurk unexamined at the edges in these cases which contextualize the technology and form our questions and responses."³ I want to explore the "background assumptions and practices" which framed the artificial heart experiment by first rendering an historical and quasi-ethnographic depiction of the development and use of the artificial heart. In it, I will draw out some of the broader implications of the story, focusing on the themes of commercial interest, Christian values, and technoscientific inertia. Second, in attending to the cultural ramifications of the experiment, I will address a theory of scientific production, posed against culture, which might explain the Jarvik-7's ultimate failure: Bruno Latour's actor-network analysis. A Latourian account forms a test-case for considering the degree to which culture impinges on technoscience. I use Latour to illuminate the instrumentality of the technoscientific perspective. Third, I consider an opposed attempt to figure the development of technoscience: Donna Haraway's ironic but

¹ Claudia Wallis, "Living on Borrowed Time," *Time*, 13 Dec. 1982, p. 73.

² M. Meslin, "Heart," in *The Encyclopedia of Religion*, ed. Mircea Eliade, (New York: Macmillan and Free Press, 1987), pp. 234-237.

³ "Severing the Ties: Fragmentation and Dignity in Late Modernity," *Knowledge and Society*, no. 9 (1992), p. 169.

hopeful "manifesto for cyborgs."⁴ How does Barney Clark compare to the cyborgs which populate Haraway's science fiction world? Finally, I situate all this within a broad interpretive framework: the problem of meaning and the question of modernity. Max Weber warned that certain practices of reason—those which together formed the process he called "rationalization"—if divorced from the presence of value or meaning, would lead to a routine and mundane human existence. The instrumentality and absence of meaningful ends often described in the production of the machinery of technoscience—in the construction of black boxes⁵—leads me to ask: in the plastic heart, did we discover an iron cage?

A Brief History of the Jarvik-7 Total Artificial Heart⁶

It could begin in 1963, with the establishment at the National Institutes of Health (NIH) of an artificial heart research program within the National Heart Institute. It could begin in 1967, when medical technologist Willem Kolff established at the University of Utah an institute called "Biomedical Engineering and Division of Artificial Organs." It could begin in August, 1976 when Kolff formed Kolff Associates, a commercial venture for manufacturing multiple kinds of artificial organs. But it might as well begin in the seventeenth century. William Harvey, an anatomist in England, was the first scientist to publish a treatise on the "Circulation of Blood in Humans and in Animals," advocating the view that the heart and the circulatory arteries and blood vessels formed a single system for transporting blood to and from the body's tissues. It was then, in the theater of vivisection and anatomical demonstration before students and fellow scientists, that Harvey theorized the human heart as a pump, a mechanical pump. Three hundred years later, after the effects of the

⁴ "A Manifesto for Cyborgs," in *Simians, Cyborgs, and Women* (New York: Routledge, 1991), pp. 149-182.

⁵ The term "black box," has been popularized by Bruno Latour. It refers to those instruments whose principles of operations are not needed to be known in order to be used. See his *Science in Action* (Cambridge: Harvard University Press, 1987).

⁶ What follows includes information taken from a variety of sources. For the sake of brevity, have chosen to note those here rather than repeatedly throughout the narrative. They are: Gilbert Omenn, "The Role of the Federal Government," in *After Barney Clark*, ed. M. W. Shaw (Austin: University of Texas Press, 1984), pp. 55-68; Renee Fox and Judith Swazey, *Spare Parts* (New York: Oxford University Press, 1992); Barton Bernstein, "The Pursuit of the Artificial Heart," *Medical Heritage*, No. 2 (1986), 80-100; Malcolm Carter, "The Business Behind Barney Clark's Heart," *Money*, April 1983, pp. 130-144.

"machination" of the body took hold in medical science and in Western culture, Harvey's great discovery was literalized in the materials of titanium and plastic through the commercial-medical-technological genius of a group of researchers gathered in Salt Lake City.

In the 1960s, the U.S. government had determined that an artificial heart program might be a worthwhile research endeavor. The government had an interest in prolonging the lives of those people which heart disease was mostly likely to strike: middle-aged to older white males. Heart disease was (and is) the leading cause of death in the United States. The government reasoned that if feasible, the artificial heart would prolong the lives of a key sector of the work force, and the resulting rise in the gross national product would more than offset the costs of researching and developing the heart. The project would also symbolize the state's capacity for technological mastery. The government thus sought an analogue on earth, in the body, for the technological push that would put a man on the moon. Indeed, outer-space and innerspace were collapsed repeatedly throughout the development and implantation of the artificial heart, each collapse an instance of the capacity of the artificial heart to form a microcosm of human concerns on a (here) cosmological scale. In 1965, the National Heart Institute hired six firms, *most of them aerospace firms*, to study the possibility of manufacturing an artificial heart. Further, "...one Nobel laureate at the time remarked that a totally implantable artificial heart was no more difficult than launching a space satellite."⁷ During the Clark implantation, the medical team conducted press conferences on the "NASA model." Clark, in letters from children sent to him during the experiment, was explicitly likened to an astronaut. "Medstar was the company filming [Bill] Schroeder's [the second Jarvik-7 recipient] experience, Black Star the photography agency. And Dr. William DeVries [listed] the chronological order of events for Schroeder's surgery in the manner of a space-launch countdown—minus twelve days, then minus eight..."⁸ Barney Clark died a "gallant pioneer," an explorer and discoverer of human capacity.

Medical historians and sociologists have noted that throughout the research and development of the artificial heart, relentless optimism prevailed among the scientists involved. The optimism included not only the confidence that a totally implantable artificial heart was technologically possible, but also that it would improve

⁷ Bernstein, "Pursuit," p. 82.

⁸ Charles Siebert, "The Rehumanization of the Heart," *Harper's Magazine*, Feb. 1990, p. 57.

the lives of its recipients. Indeed, "...by their set of assumptions, all recipients of the artificial heart would return to normal life, and would live a *longer* and more healthy life than other people."⁹ Initially, then, the artificial heart would not only salvage a human life, it would create a superior life form. But as the technological barriers to the development of the device became apparent, the initial optimism about improving the quality of life for those receiving it faded into the background, while the push to show that such a device could be made was redoubled. It was redoubled in the face of developments in heart transplantation technologies (in particular the drug cyclosporine) which allowed heart transplantation, originally an extremely dangerous endeavor, to achieve a modicum of success. The artificial heart effort then responded to scarcity: while transplantation had been made possible, there were not enough transplantable hearts to go around. Though the potential market for artificial hearts had decreased, it still remained lucrative to emerging biotechnology industries.

The U.S. poured ten million dollars a year into the project, beginning in 1966. Researchers faced four major problems. First, no known materials existed at the time which were flexible enough and which did not damage human blood. Second, a pump mechanism had to be designed which could force blood through the body without destroying the blood cells. Third, a power source was needed. Fourth, researchers wanted to develop an interface with the autonomic nervous system. Perhaps as a further instance of the space-innerspace connection, researchers early on pursued a nuclear-powered heart (!). Was the idea to implant a device like a nuclear-powered satellite inside a human chest? The notion was heavily criticized, as Barton Bernstein notes: "The amount of plutonium would make the recipient an ideal kid-napping victim. Accidents or terrorists might release the plutonium, possibly killing thousands. And furthermore, the recipient, as well as the people around him, would slowly be irradiated, increasing the risk of cancer."¹⁰

While research was conducted at several public institutions across the country, most notably at Pennsylvania State University and the Texas Heart Institute, the research which eventually led to the first permanent human implantations was conducted in Utah. There, Willem Kolff, a Dutch doctor and technological experimentalist formed a team of doctors in 1967, including the one who would ultimately conduct all of the permanent artificial heart transplants, William DeVries, to de-

⁹ Bernstein, "Pursuit," p. 82.

¹⁰ "Pursuit," p. 85.

velop the artificial heart. The team also included Robert Jarvik, the heart's namesake. Throughout the 1970s, the team conducted research on animals, removing the hearts of healthy calves and sheep and replacing them with versions of the Jarvik heart. "There was no ability to develop a compact, reliable power source; the calves, when tested, were tethered to a large power console and they ran or walked on a treadmill."¹¹ None of these early versions worked very well. In a third of the animal implants, the plastic device experienced some sort of mechanical failure. In 24 of these cases, the failure was catastrophic, so the animals were either killed by it or had to be destroyed. Despite these circumstances, the team felt they were approaching a clinically testable heart.

Potential profits pressured the team toward clinical trials. The team's "optimism" was glossed as "entrepreneurial spirit" by businessmen. *Money* magazine told a story that "...involves the lives, fortunes, and entrepreneurial spirit of the people who built Barney Clark's heart, and the closely connected tale of the company they founded to develop and manufacture this and other replacements for failing human organs. It is both a cautionary and an inspirational tale for anybody starting or investing in a new venture."¹² There was, it seems, a price on life. National policy encouraged this commercialization of medical research. Under both Carter and Reagan, policies to "stimulate innovation" in biotechnology included revisions of patent policy, anti-trust policy, tax policy, regulatory postures and procurement practices.¹³ The body was becoming a site (or target) for commodity production.¹⁴ If the artificial heart was to be seen as a source of national pride, as was the space program, it first had to pass through the interests of eager capitalists looking to open new markets.

By 1983, Kolff Associates became Kolff Medical Incorporated. (The company was later renamed Symbion.) It had \$5 million in venture capital from Hospital Corporation of America, Humana, American Hospital Supply, Southwest Venture Partners, and General American Investors. To name these organizations is to make visible the profits behind "progress," and to tie government and public money to the interests of venture capitalists. Early on, investors had taken a particular liking to

¹¹ Bernstein, "Pursuit," p. 85.

¹² Clark, "Business," p. 130.

¹³ Omenn, "Government."

¹⁴ See Paul Rabinow, "Artificiality and Enlightenment: From Sociobiology to Biosociality," in *Incorporations*, ed. J. Crary (New York: Zone Books, 1992), pp. 234-252.

the connection Kolff Associates maintained with the University of Utah. Lee Smith, a vice-president at Kolff, said, "That was the company's biggest advantage—it had the university as its research-and-development arm subsidized by the government."¹⁵ Thus, the production of knowledge and the faith in the progress of technology had nestled within them the proprietary interests of a group of venture capitalists and their technoscience partners. The push toward clinical trials was intensified due to competition: "As a matter of pride and pragmatism, Kolff Medical wanted one of its devices to be the first permanent replacement of the heart."¹⁶

The team, despite some dissent, felt by 1980 that the time was near for clinical trials on human beings to begin. Several factors, including the proprietary interest just mentioned, played a role in the decision to begin seeking FDA approval for an experimental protocol for human patients. First, researchers had managed to sustain animal life on the artificial heart for over five months. They reasoned that a human patient with end-stage heart disease would probably live longer on the artificial heart than without it. Second, because experiments had only been conducted on healthy animals, researchers felt that they had learned all they could from them. The effects on a sick organism had not been monitored. Third, the pervasive optimism of the program affected calculations of the risks involved in human trials. Renee Fox and Judith Swazey have called this "ritualized optimism":

What we call *ritualized optimism* blends scientific and clinical knowledge and judgment with a degree of optimism in the face of uncertainty that often seems to involve magicoreligious dimensions. In the case of the Jarvik-7 heart, one hope and expectation was that the human body would be as or more "tolerant" of the device than the bodies of calves and sheep, and that complications accordingly would be less severe.¹⁷

By September 1981, the FDA had authorized the team of physicians led by William DeVries, and incorporating Kolff Medical/Symbion, to perform a series of seven implants. The original protocol called for finding a suitable transplantation candidate who could not fully recover from cardiac surgery and needed to use a heart-lung machine to survive. In May, 1982, the protocol was expanded to include any class IV cardiomyopathy patient who was ineligible for a human heart transplant as a potential candidate.

¹⁵ in Carter, "Business," p. 143.

¹⁶ Carter, "Business," p. 143.

¹⁷ *Spare Parts*, p. 107.

The design of the "heart" to be used in the clinical trials included modifications made over a period of almost fifteen years of development. The heart consisted of two round ventricles with "anatomic transitions to the great vessels and atria."¹⁸ Each of the "ventricles" was air-powered. Air was pushed through the chambers at rates of 40 to 120 beats per minute. The material used for the ventricles was a "smooth blood surface" made of segmented polyurethane. The heart pumped 100 ml of blood per contraction. "Connections to the natural atria [were] achieved by cuffs made of Dacron felt. These [were] connected to the total artificial heart by a system consisting of rigid polycarbonate segments."¹⁹

Candidates for the procedure underwent extensive psychiatric evaluation to determine whether they and their families were psychologically prepared for the trauma of experimental surgery. Barney Clark was eventually identified as an "ideal candidate" for the artificial heart. Before surgery commenced, Clark was shown the operations of Kolff Medical/Symbion. He toured the animal barn where animals were kept alive by artificial hearts. As his condition worsened, and the operation appeared immanent, Clark signed an eleven page consent form to protect his "individual autonomy."²⁰ It is ironic that while a great deal of attention was paid to preserving Clark's sense of individual autonomy as an ethical issue, it was at this moment of attention that Clark's autonomy would be permanently and visibly revoked.

A dentist from Seattle, Clark was a devout Mormon. Fox and Swazey have pointed out that the Mormon setting of the operation, Salt Lake City, had a powerful effect on the experiment's progress.²¹ Many of those involved in the experiment were Mormon, including William DeVries, the head surgeon; Chase Peterson, Vice President for Health Sciences at the University of Utah and coordinator and media spokesman for the artificial heart project; and Ross Woolley, Vice Chairman of the Institutional Review Board which oversaw the entire experiment. Fox and Swazey argue that the Mormon emphasis on "extended family" allowed a particularly close relationship to form between the Clark family and the implant group. Further, the

¹⁸ William DeVries et al., "Clinical use of the total artificial heart," *New England Journal of Medicine*, 310 (1984), p. 273.

¹⁹ DeVries et al., "Clinical Use," p. 273.

²⁰ Jay Katz, "Patient Autonomy and the Process of Informed Consent," in *After Barney Clark*, ed. M. W. Shaw (Austin: University of Texas Press, 1984), pp. 11-24.

²¹ *Spare Parts*; Renee Fox, "It's the Same But Different," in *After Barney Clark*, ed. M.W. Shaw (Austin: University of Texas Press, 1984), pp. 5-11.

themes of pioneering discovery and exploration in the experiment resonated with the Mormon identification with the settlement of the American West. At Clark's funeral, attended by more than 1,300 people, Peterson eulogized Clark: "We express our respect and sympathy to Mrs. Clark and her children, and especially to Dr. Clark who was—and I suspect is—a remarkable man, a pioneer to match these Western lands." An elder of the Mormon church followed these remarks thus: "True scientific research is but the carefully ordered expression of that mortal drive and hunger and quest to know more of what God knows. [Barney Clark's experience with the artificial heart was] ...a unique second salute to God in gratitude for the gift of mortal life.... To a world increasingly filled with hopelessness and despair, he stood quietly, but resolutely for an entirely different view of life."²² These themes replicate Mormon doctrine, a kind of this-worldly asceticism wherein activity in the world discloses the truth of the universe, the truth of God. Fox and Swazey, in response to critics, have also pointed out that these themes are equally "American," even if they were given a uniquely Mormon inflection at the Salt Lake City site. I will suggest later that this articulation of the artificial heart experiment within a sphere of values is one instance of an attempt to render meaningful the experiment and the death of Barney Clark. But it remains eulogy; that is, *after*. It does not account for the technoscientific push (which included forces as large as the U.S. government) that produced the heart and organized the experiment in the first place.

Clark's surgery occurred the night of December 1, 1982. The surgical procedure was graphically described in the press coverage of the operation. An article in *Time* the week following the surgery included a diagram of the artificial heart, mapping its design as a kind of plumbing system, with pipes for input and outflow. It recorded that two thirds of Clark's heart was cut away, following a 9.5 inch incision in his chest.²³ The article conveyed a sense of optimism, as if the operation had been therapeutic as opposed to experimental. In fact, the article never once mentioned that the surgery was part of an experiment—it talked about "future patients," presuming that such patients would at some point come to pass.

Surprisingly soon, the artificial heart itself faded from view. After the operation, Clark's heart output "...was normal, he had what was described as 'the blood pressure of an 18-year old...'"²⁴ Dr. Peterson said after Clark's surgery: "Barney

²² in Fox and Swazey, *Spare Parts*, p. 164.

²³ Wallis, "Borrowed Time."

²⁴ Wallis, "Borrowed Time," p. 62.

Clark is not an artificial heart patient now. He's simply a seriously ill post-operative patient who has had complications and could have more."²⁵ This signals the (at least momentary and if only imaginary) closing of a black box: the heart was seen to work perfectly, to stabilize the circulatory system like a charm, in the eyes of the popular press.

Barney Clark died one hundred twelve days after the operation, on March 23, 1983. His death was attributed to the collapse of his remaining "natural" organs, due to the progression of heart disease before the artificial heart implant. As noted earlier, he received a eulogy of national proportions.

After the Clark experiment, the research team was scrutinized by journalists, other doctors, social scientists, and medical ethicists.²⁶ Questions which had not been emphasized before the experiment now came to the foreground. Had the right decision been made to move from experiments on animals to clinical trials in human subjects? Had informed consent really been possible for Clark, who consented under the duress of extreme physical suffering? Had the heart really worked as well as the doctors said? What did the death of Barney Clark ultimately mean?

In the midst of this attention, William DeVries made a dramatic decision: he moved to Louisville, Kentucky to establish an artificial heart research program for the Humana hospital corporation. Humana had invested money in the research up to that date, and promised less bureaucracy and more money than was available at the University of Utah. It was at Audobon Hospital outside Louisville that the next four experimental operations would take place. Significant among these was the case of Bill Schroeder, who lived the longest of any of DeVries' artificial heart patients, 620 days.²⁷ The media attention that had been focused on Clark was focused just as intensely on Schroeder. He received a phone call from President Reagan.

Despite the relative success of Schroeder's operation, enthusiasm for the Jarvik-7 artificial heart began to wane. By 1988, the National Heart, Lung and Blood Institute decided to cancel contracts for studies of a totally artificial heart. Emphasis shifted to a more practical (but less spectacular) left ventricle assist device. *Science* magazine reported: "Although the heart institute has spent approximately \$240

²⁵ in A. Toufexis, "And the Beat Goes On," *Time*, 20 Dec. 1982, p. 71.

²⁶ M.W. Shaw, ed., *After Barney Clark* (Austin: Univ. of Texas Press, 1984).

²⁷ See Martha Barnette, *The Bill Schroeder Story* (New York: William Morrow and Company, 1987).

million on all types of artificial heart research since the 1960s, a number of problems related to the polymer chemistry of the heart, the force with which it pumps, and a safe, miniature power source remain to be resolved before a totally implantable heart is on the horizon."²⁸ But as the author noted, the Institute "...failed to take politics into account." Senators Orrin Hatch (R-UT) and Edward M. Kennedy (D-MA) opposed the decision to remove funding for research. Both were acting in the fiduciary interests of their constituents. Hatch wanted to keep millions of dollars of funding at the University of Utah. In Kennedy's case, a major new biotechnology firm in Massachusetts ran the risk of losing significant funding. These "politics of the heart" juxtaposed the values of scientific neutrality against the political and economic context in which that perspective is situated: "The NIH's struggle for freedom from political interference has been going on for years. For its side, NIH has the power of scientific reasoning; Congress has plain power. It is not a level playing field."²⁹

Black Box, Iron Cage

This diagnosis of a perceived institutional asymmetry might be read as a criticism of Bruno Latour's actor-network theory of scientific production. Latour has argued that, "In our modern societies most of the really fresh power comes from sciences—no matter which—and not from the classical political process."³⁰ Against a sociology of science which would explain science by way of social and cultural forces, Latour posits a theory of strategically operating scientists who, in fact, construct and transform those forces. Scientists secure truth and produce technoscientific machinery—make black boxes—by translating the interests of social groups into their own. Thus, on a Latourian accounting, Kolff and company translated the interests of the government, venture capitalists, and millions of males at risk for heart disease by proposing their artificial heart as the most efficient and trustworthy solution to the problems of heart disease. In Latour's view, scientists recruit allies and appropriate the interests of others through the use of inscription devices: they write articles designed to authorize their own truth claims.³¹ Latour repeatedly and

²⁸ Barbara Culliton, "Politics of the Heart," *Science*, 241 (1988), p. 283.

²⁹ Culliton, "Politics," p. 283.

³⁰ Bruno Latour, "Give Me a Laboratory and I Will Raise the World," in *Science Observed*, eds. K. D. Knorr-Cetina and M. Mulkay (London: Sage, 1983), p. 168.

³¹ See Bruno Latour and Steve Woolgar, *Laboratory Life* (Princeton: Princeton Univ. Press, 1986/1979).

forcefully argues that cultural and social contexts cannot be used to account for the successes, or the failures, of science.

But that is precisely what I intend to do. The "fresh power" of which Latour speaks above, and as part of his actor-network theory wants to keep in the hands of scientists alone, is always thoroughly mediated by power in other domains: for example, the economy in the form of proprietary interest and the political process in the form of government funding and regulatory policy. In contrast to Latour, I want to consider the fate of the Jarvik-7 from a social perspective. In 1988, the device survived the test and continued to accrue government research funds. In 1990, however, the FDA removed approval of it for use in human clinical trials. Why did the plastic heart not become a black box, one of those pieces of technology whose efficacy is so taken for granted that its history of construction and principles of operation are hidden in its use? The answer lies in the contexts of technoscientific production. Here, I elucidate two: one cultural, the other social and institutional.

The cultural context is complex. For that reason, I will only track a few of the major themes which "heart" might call to mind. Any consideration of the image of the human heart (or for that matter the human body) in the United States (or for that matter the West) must take into account the rich Christian heritage within which "flesh," "blood," and "heart" have come to signify. The heart in particular, as the site of the true self, that very intimate space wherein the individual constitutes him or herself in relation to Jesus Christ ("let Jesus into your heart"), manifests multiple Christian themes. St. Augustine said, "My heart is where I am, such as I am."³² An individual's very humanity, not to mention her individuality, is uniquely symbolized in the heart, just as the "sacred heart of Jesus" and the blood which flowed from it symbolized Christ's humanity, his embodiment as human. Thus (Western) personhood, as a constellation of concepts including individuality, embodiment, autonomy, and humanity, is enshrined uniquely in the heart.³³

The heart is also an emblem of different kinds of sociality. It is social relations lived through the body, as noted by James Lynch:

³² in Meslin, "Heart," p. 236.

³³ See Fox and Swazey, *Spare Parts*; Clifford Geertz, "From the Native's Point of View": On the Nature of Anthropological Understanding," in *Local Knowledge* (New York: Basic Books, 1983), pp. 55-73; Emiko Ohnuki-Tierney, "Brain Death and Organ Transplantation: Cultural Bases of Medical Technology," *Current Anthropology*, 35 (1994), pp. 233-254.

Almost as soon as man discovered the existence and function of the heart, he recognized that it was influenced by human companionship and love... In an endless variety of verbal and nonverbal dialogues with others, we have learned that human beings have varied, and at times profound, effects on the cardiac systems of other human beings.³⁴

Not just romantic love, but friendship and family, are inscribed in the heart, in its rises and falls, as it breaks and as it sings.

More broadly, the artificial heart experiment was framed by large contestations over the configuration of the body as a whole,³⁵ and the relationship between something called "nature" and something called "culture."³⁶ Emily Martin has noted that in the contemporary United States, the very boundary of the body is at present under negotiation. Is the body a bounded whole which must defend its borders, or is it a flexible, complex system whose boundary is diffuse, porous? These questions are asked in multiple areas of social life, from the immunology lab to the workplace. Martin records a telling statement about the possible refiguration of "person" and "body" as they relate to the heart; one of Martin's subjects said, "I don't even think about the heart anymore; I think about the immune system as being the major thing that's keeping the heart going in the first place..."³⁷ Rabinow, in a similar vein, writes:

The approach to "the body" found in contemporary biotechnology and genetics fragments it into a potentially discrete, knowable, and exploitable reservoir of molecular and biochemical products and events. By reason of its commitment to fragmentation, there is literally no conception of the person as a whole underlying these particular technological practices.³⁸

While I appreciate the observation, it is open to question just how widespread the effacement of the integrity of the body is in both technoscience and in society at large. An important theme in the attempts to make meaning out of the deaths of Barney Clark and the Jarvik-7's other recipients was the infraction on the wholeness

³⁴ *The Broken Heart* (New York: Basic Books, 1977), p. 11.

³⁵ See especially Emily Martin, "Toward an Anthropology of Immunology: the Body as Nation-State," *Medical Anthropology Quarterly*, (n.s.) 4 (1990), pp. 410-426; Emily Martin, "The End of the Body?" *American Ethnologist*, 19 (1992), pp. 120-138; and Rabinow, "Fragmentation."

³⁶ See Rabinow, "Artificiality," and Haraway, "Manifesto."

³⁷ in "The End...?" p. 123.

³⁸ "Fragmentation," p. 186.

of their bodies. The body in these circumstances is neither fragmented nor a complex system—it is simply under question.

Finally, the heart symbolizes a condition of knowledge itself. The “heart” of something is said to be its deep significance. “To get at the heart of something,” means to uncover the layers which surround or obscure the facts. In this way, the heart is an analogy or metaphor for an epistemological framework; it calls for an uncovering, a decoding, a revealing of a foundational truth. The truth of the body, of the individual, of the self, is therefore a microcosm of “truth” in general. It is a truth embedded in the body, lived in the heart. Christian tradition is, again, paradigmatic. Michael Meslin, in tracking the image of the heart in the history of religion and philosophy in the West writes:

[The heart] is will, and through it the individual is defined and expressed. But it is, in addition, the organ that knows an order superior to that of reason: “It is the heart that feels God and not reason: this is what faith is, God is susceptible to the heart and not to reason.” Pascal meant that reason is not useless, but that it remains insufficient, for it belongs to the natural order, whereas “the heart has reasons that reason knows not.” The knowledge of God is not an abstract thought; it emerges from the very existence of man, and it resides in the desire for abundance: “My whole heart reaches out to know where the true good is in order to follow it.” For as Pascal wrote in 1658... “man discovers the truth of which he speaks inside himself.”³⁹

To sum up, the heart is a trope, a constituting concept or image, for personhood, individuality, social relationships, love, understanding, and ultimately truth itself. These resonances brought the world to Salt Lake City to see on television, in magazines, in newspapers, the excision of a man’s heart and its replacement with a plastic pump. They kept the operation in the public eye for years afterward. Moreover, Latour’s theory notwithstanding, this cultural context cannot be irrelevant to the eventual failure of the artificial heart program.

The institutional apparatus which in some ways was dissonant with this cultural context included first that complex of universities, hospitals, institutes, and associations in the United States which might be designated *the health care system*. Increasingly through the last half of the twentieth century, and particularly in the 1980s and 1990s in the United States, “health care” includes a highly commercialized intersection of corporate activity and knowledge production: the biotechnology

³⁹ “Heart,” p. 237.

industry. Rabinow and Martin have been particularly attentive to this development. Under the 1980 Patent and Trademark Amendment Act, the state sanctioned the confluence of publicly funded scientific research with proprietary interests: “To prompt efforts to develop a uniform patent policy that would encourage cooperative relationships between universities and industry, and ultimately take government-sponsored inventions off the shelf and into the marketplace,” universities were required to report any possibly patentable invention.⁴⁰ As a result, from 1980 to 1984 patent applications from universities rose 300% for biotechnologies. The production of knowledge was greatly affected: “...scientists with ties to industry were five times as likely as their unindustrially connected colleagues to withhold research results from publication.”⁴¹ Rabinow argues that technoscience and modern rationalized capitalism have thus combined in new ways in the 1980s and 1990s. Scientists increasingly are looking for ways to transform their symbolic capital into monetary capital. This accounts for a newly intimate commodification of “nature,” which Rabinow, citing Frederic Jameson, calls one of the hallmark traits of “late capitalism.” Martin has made visible the cultures (both biological and symbolic) of late capitalism, a regime characterized by flexible accumulation: “I am suggesting that the science of immunology is helping to render a kind of aesthetic or architecture for our bodies that captures some of the essential features of flexible accumulation.”⁴² In sum, the artificial heart experiment was carried out in a newly commercialized intersection of government, university, and medical institutions.

The intersection has had consequences. As noted earlier, the rush to use the Jarvik heart in experiments on humans was at least partly a rush to a new market and new profits. For Latour, it is scientists who translate the interests of others (including businessmen) into their own. It is this translation of interests, and the resulting network of allies who are obliged to mediate their own interests through those of the scientists, which allows scientists to make the facts they do, to produce new forms of power, and to transform society.⁴³ In this case, however, it appears that the scientist followed the capital, not the other way around. DeVries’ move to Humana was clearly a corporate strategy to appropriate the activities of a scientist in an effort at image building and prestige creation. The corporation thought that the successful artificial heart would convey esteem upon the corporation. Furthermore, commercial activity had the effect of circumscribing the production of knowledge.

⁴⁰ Rabinow, “Fragmentation,” p. 172.

⁴¹ Rabinow, “Fragmentation,” p. 173.

⁴² “The End...?” p. 126.

⁴³ Latour, “Give Me”; and Latour, *Action*.

As Rabinow noted, scientists, in an effort to gain private funding by protecting proprietary interests, *stop publishing* (so much for Latour's vision of rhetorically secured truth among a community of peers).⁴⁴ This was especially true in the artificial heart experiment. DeVries and company were lambasted for failing to publish the results of their experiment in a timely fashion. One observer said at a conference held to analyze the Clark experiment:

As we approach the first anniversary of Dr. Clark's artificial heart implantation, I am unaware of any scientific report that has appeared in any medical journal. I am astonished... The most frequent comment I hear from cardiologists and medical leaders with whom I have discussed Dr. Clark's case is that they feel limited in what they have been able to learn about the case. Stated more bluntly, the cardiologists say that they do not have enough scientific information to discuss it in an intelligent way.⁴⁵

DeVries eventually published his findings,⁴⁶ only months before announcing that he had secured a significant capital commitment from Humana.⁴⁷

The conjunction between university research and commercial activity finds its apotheosis in the relationship between Kolff Medical/Symbion and the University of Utah. Again, this impacted the availability of information about the process of the Jarvik-7 experiment. A commentator wrote:

The new Utah research protocol, like the earlier protocol there with DeVries and apparently like the protocols filed by other artificial-heart researchers elsewhere, is closed for proprietary reasons to the public and even to other technologists and scholars. Put bluntly, Symbion and other companies, even though they have benefited handsomely from federal funding for this research [\$8 million], want to keep much of what they have learned secret so that they can do better in the marketplace. The result is a troubling new relationship between universities, which claim to prize openness and sharing knowledge, and

⁴⁴ See Bruno Latour and Steve Woolgar, *Laboratory Life* (Princeton: Princeton Univ. Press, 1986/1979).

⁴⁵ Lawrence Altman, "After Barney Clark: Reflections of a Reporter on Unresolved Issues," in *After Barney Clark*, ed. M. W. Shaw (Austin: University of Texas Press, 1984), pp. 116, 118.

⁴⁶ DeVries et al., "Clinical Use."

⁴⁷ Fox and Swazey, *Spare Parts*, p. 117.

private firms, which stress secrecy and retaining the benefits of knowledge.⁴⁸

This surely complicates Latour's argument about fact construction. Scientific facts no longer need be public, they mostly need to have secured funding. Moreover, to secure funding may require no more "recruitment" or "interressement" than simply dialing up a venture capitalist with a few million dollars to spare (Carter notes that Kolff Medical's early funding was due partly to a lucky phone call).⁴⁹

The artificial heart experiment did not perceive the body as a whole system. Eric Cassall, in an extremely interesting criticism of the experiment, argued that medicine as a whole tends to treat organs as discrete functions rather than as larger, integrated systems. He wrote in 1984:

In listening to the manner in which people, including doctors talk about artificial organs, one might come away with the belief that all the organs just sit there doing their own thing and that from that concert of individual actions, the functioning of the whole organism occurs. I was led to believe that the same viewpoint was, at least, initially, held by the Utah team, because when Dr. Clark died, it was reported that his artificial heart had worked fine, but that his kidneys and his lungs did not hold up because they were so diseased prior to the implant.⁵⁰

Cassall noted that the introduction of a robust heart rate and a normal blood pressure to a system adapted to a sick heart would surely be catastrophic. The uniformity of the pump, its standard design, necessarily prevented it from integrating properly into a body with a history and development of its own. Furthermore, it is now open to question whether previous ideas about the constancy of the heart rate captured the way in which the heart pumps blood through the body.⁵¹

Why did Kolff, Jarvik, DeVries, et al. fail in establishing the heart as a therapeutic instrument? They had a huge network, incorporated massive resources both public and private, and were ostensibly in a position to appropriate the interests of Americans with heart disease. We might answer this question by visiting a prior one: why did they try to build the artificial heart in the first place? As I noted, early

⁴⁸ Bernstein, "Pursuit," p. 96.

⁴⁹ Carter, "Business."

⁵⁰ "How is the Death of Barney Clark to be Understood?" in *After Barney Clark*, ed. M. W. Shaw (Austin: University of Texas Press, 1984), p. 21.

⁵¹ See Timothy Denton et al., "Fascinating rhythm: a primer on chaos theory and its application to cardiology," *American Heart Journal*, 120 (1990), 1419-1440.

on in the research and development of the artificial heart, scientists thought that the recipients' quality of life might be improved by the apparatus. Initially, therefore, the project was meaningful in the sense of having a relation to values, those ultimate values which make life worth living. What happened to that perspective? It faded. The image of the completed heart, simply sustaining a life (whether or not it improved it), was fundamentally seductive. A quote from a senior cardiac surgeon involved in the operation is illuminating:

As we stood on the threshold of taking the artificial heart to the clinic, everyone sensed the dilemma that [the device] was not yet ready to support real human existence.... [But] a whole symphony of technology gave us the feeling that maybe the [Jarvik] heart was going to work.⁵²

This captures the allure of instruments. Those observing the experiment noted early on that it was simply the promise of the instrument itself, the means in and of itself, that carried the clinical trials to fruition. One commentator wrote:

The machines we build are highly directive. For we build into them not only mechanical or electronic powers but our own aspirations. They have powerful symbolic meanings for us as well. The machine demands attention: to improve it, to discuss it, to use it, no matter what. Means and ends come together in the question, Can it work? Overriding the objective to define the effects of its use is the fact that it can be used. Like humans, once created, machines seem to acquire a right to survive, to exist, to try to make their mark. Thus machines can be addictive and compelling.⁵³

This is a powerful redescription of the black box. From this perspective, black boxes hardly form a background for action. Rather, they direct it, control it, motivate it. Latour knows this, and it is for this reason that he sees scientists as having a lock on power in contemporary society. But it leads me to a criticism that Latour might not have expected.

Max Weber argued that modernity was in danger of becoming (had it all ready happened?) a condition of entrapment by the multiplication of means without a simultaneous multiplication of meaningful ends. Weber counterposed one type of reason, instrumental rationality, against another, value rationality. Instrumentally

⁵² in Fox and Swazey, *Spare Parts*, p. 95.

⁵³ Stanley Reiser, "The Machine as Means and End: the Clinical Introduction of the Artificial Heart," in *After Barney Clark*, ed. M. W. Shaw (Austin: University of Texas Press, 1984), p. 172.

rational action, "...is determined by expectations as [to] the behavior of objects in the environment and of other human beings; these expectations are used as 'conditions' or 'means' for the attainment of the actor's own rationally pursued and calculated ends."⁵⁴ This kind of action was counterposed to that which is "...value-rational, that is, determined by a conscious belief in the value for its own sake of some ethical, aesthetic, religious, or other form of behavior, independently of its prospects for success."⁵⁵ Weber feared that without the presence of both these aspects of social action, society would rationalize itself into an iron cage, devoid of meaning. And he insisted that science alone is incapable of filling that void.⁵⁶

Now, instrumental reason would appear to describe the activities of scientists, particularly as Latour portrays them. One criticism of Latour might therefore emphasize the role meaning plays in the various productions of science, for example in the inscription of Mormon values in the research conducted at Kolff Medical and the University of Utah. Instead, I want to entertain the idea that Latour may be on to something in his analysis of contemporary science. Note the following passage:

By staking all social explanations of science and technology on the classical view of politics and economics—profit, stated power, predictable evils or goods—analysts of science who claim to study the macrolevels fail to understand precisely what is strong in science and technology. In speaking of scientists who make politics by other means, their boring and repetitive critique is always that they "just make politics," period. Their explanation falls short. The shortness of it is in the period—they stop where they should start. Why though are the means different? To study these other means, one must get inside the contents of the sciences, and inside the laboratories where the future reservoirs of political power are in the making.⁵⁷

In Latour's "boring and repetitive" account of science, the thesis is that scientists just make means, period. Latour repeatedly rejects reparations to ideas like "meaning," "context," or "culture," as an explanation of science: "...it is not necessary to search for political drives, for some short-term monetary or symbolic profits or for long-term chauvinistic motives. It is no use looking for unconscious ideolo-

⁵⁴ "Basic Sociological Terms," in *Economy and Society* (Los Angeles: University of California Press, 1968), p. 24.

⁵⁵ "Basic Sociological Terms," p. 25.

⁵⁶ See especially, *The Protestant Ethic and the Spirit of Capitalism* (New York: Harper Collins, 1991 [1930]), and "Science as a Vocation," in *From Max Weber*, ed. Gerth and Mills (London: Oxford University Press, 1946), pp. 129-159.

⁵⁷ "Give Me," p. 168.

gies or devious drives.... It is no use muckraking."⁵⁸ He may be right. Science might indeed be an apparatus for the construction and dispersion of multiple instruments and technologies simply as the expression of one or another will to power. Whatever else a black box is in Latour's thought, it is at least a means, an instrument. It enables. It is, therefore, the embodiment of instrumental reason par excellence because its coordination to an end is completely transparent, that is, *objective*. Latour's analysis might therefore be ethnographic in a way he had not foreseen. In redescribing science to itself, Latour may have captured the meaninglessness at the heart of the modern scientific perspective. Indeed, scientists' insistence on their own objectivity, their rejection of values in science, might be well captured by Latour's actor-network theory.

None of that means, however, that technoscience, in all its instrumental glory, is wholly without meaning. To the contrary, it is precisely the displacement of meaning, the reconfiguration of cultural imagery which the technology allows, disallows, or must contend with, that forms the subject of the work of Haraway, Martin, and Rabinow. Unfortunately, with all his emphasis on technologies of inscription, expanding networks of allies, translations of interest, reversals of scale, etc., it appears Latour has simply given us a description of science. He has not given much of an explanation of science. In rendering an understanding (*verstehen*) of the practice of scientists, specifically, he has foreclosed an understanding of "science." My argument, then, is that the failure of the Jarvik-7 is complexly related to a failure of science in general: its general disregard for the problems of meaning which inevitably attach to it. In instrumentalizing the body as a congeries of discrete functions, the heart researchers failed to see the body as a cultural and historical product, a specificity not necessarily amenable to the standardizing "machinations" of science. Furthermore, in not attending to the potential consequences of their actions for how people conceptualize humanity and personhood, the Jarvik team disclosed an abhorrent image, the cyborg figure of Barney Clark, which jeopardized their project in a domain they refused to see: culture.

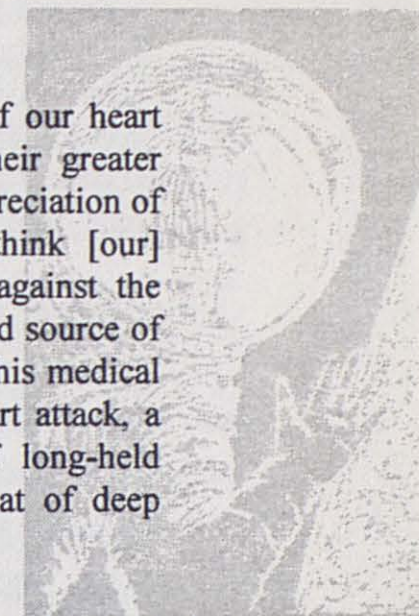
Plastic Heart, Cyborg Body

As I have shown, the experiment did not pass without notice. It received intense scrutiny, not all of it celebratory. Many responses to the artificial heart pon-

⁵⁸ "Give Me," p. 157.

dered its cultural and ethical consequences.⁵⁹ In a fascinating essay, "The Rehumanization of the Heart," the poet Charles Siebert described his own "heart hypochondria," his constant fear that his heart was failing him. He wrote that the condition was proliferating among his acquaintances:

I've since come to the frightening conclusion that many of our heart specialists actually believe what they are saying—that their greater scientific knowledge of the heart had led to a diminished appreciation of the heart's subtleties and its spiritual significance.... I think [our] increased cardiac paranoia is... a subconscious rebellion against the demystification of the heart, the reduction of a once profound source of mystery and misgiving to a mere machine. In response to this medical reductionism, we may be suffering a kind of collective heart attack, a modern metaphysical one—pained by the weakening of long-held notions of the heart as the home of the soul and the seat of deep emotions.⁶⁰



Siebert argued that medical science was in danger of erasing the rich associations which the human heart conveyed. And he made explicit what had remained largely unnoticed, that each Jarvik-7 patient suffered acute organ failures that may have been caused by the artificial heart. "It's as though the organs asked for more from the heart than an efficient, robotic output, asked for some subtlety and variety of pulse, a virtuosity the Jarvik-7 was simply not capable of."⁶¹

Others asked about social justice. All the recipients of the permanent artificial heart were white men. The Jarvik-7, which cost millions of dollars to develop, was too large to fit inside the chest cavity of a woman. Consequently, some questioned the allotment of public resources for medical research which ultimately was restricted to men in its application. Moreover, throughout the story, gender imagery proliferated. The male doctors and their patients were brave heroes exploring the limits of human experience. The wife of Barney Clark embodied a different stereotype: "Una Loy Clark was the team's pioneering woman of virtue—their wifely, motherly, and grandmotherly 'heroine.'"⁶²

Finally, some questioned the ethics of presuming the autonomy of the patient. The process of informed consent, combined with the qualificatory stipulations for

⁵⁹ Collected in M. W. Shaw, ed., *After Barney Clark*.

⁶⁰ Siebert, "Rehumanization," p. 54.

⁶¹ "Rehumanization," p. 58.

⁶² Fox, "It's the Same," p. 82.

the heart experiment, combined to problematize, in disturbing ways, the "consent" conceded by Barney Clark:

...according to criteria established by the IRB, to be a suitable candidate for artificial heart implantation, a patient had to be near death from chronic congestive heart failure. It requires little clinical experience to know that sick persons cannot read and correctly comprehend eleven pages of technical information about the device that offers them their only hope of returning to life.⁶³

All in all, the "autonomy" of the subject was called into question: first, because of his psychological condition at the time of the experiment; second, because no person is completely separate from society, which is to say that the effects of the experiment extended beyond that individual. The experiment affected the doctor performing the surgery, the family of the patient, and ultimately the broader community and nation. Then is the research team responsible for the broadly dispersed effects of their research, such as those criticized by Siebert? If they are, Cassall argues, then they are poorly prepared, because scientists are trained to exclude from view political and cultural issues. If they are not responsible for these effects, "...then what are the limits of responsibility in the development of radically different technologies? I am not arguing for an unlimited extension of responsibility but merely the recognition that placing a mechanical heart in an individual sick body is the beginning, not the end, of the matter."⁶⁴

These criticisms are all attempts to give meaning to the experiment, to "understand" the death of Barney Clark, as the title of Cassall's article asks: "How is the death of Barney Clark to be understood?" The authors implore science to be attentive to questions of meaning, and criticize its misapprehension of the cultural and moral dimensions of human experience. Stanley Reiser brilliantly summarizes:

The artificial heart is at once a metaphor of concern about unduly sustaining an aging population, the cost of medical care, plunging into technologic creation without adequate thought to consequences, and of an accumulation of means as an end in itself. It stands also as a metaphor of exhilaration about the wonders of our science and technology. A technologically dominated health care system works undaunted to produce ever more effective means. But to what ends?⁶⁵

⁶³ Cassall, "The Death of Barney Clark," p. 32.

⁶⁴ "The Death of Barney Clark," p. 40.

⁶⁵ "The Machine," p. 173.

These thoughts echo the critique of science proffered by Haraway, Martin, and others. However, Haraway rejects Siebert's romanticizing notions of a body before technology. She intends an ironic reappropriation of technology from the hands of the militarist males who constructed it: ironic because she takes pleasure in contradiction. She wants to blur boundaries, fragment figures, split selves, and parse perspectives. She chooses the "cyborg" as the metaphor for her new politics of technoscience. What is a cyborg? "A cyborg is a cybernetic organism, a hybrid machine and organism, a creature of social reality as well as a creature of fiction... A cyborg is a hybrid creature, composed of organism and machine. But, cyborgs are compounded of special kinds of machines and special kinds of organisms appropriate to the late twentieth century."⁶⁶ Why does Haraway choose the cyborg? She is attracted to its capacity to unsettle tacit assumptions.

One of those assumptions is a distinction between "fiction" and "reality." Cyborgs are fictive, at least in the mind of Haraway: "I am making an argument for the cyborg as a fiction mapping our social and bodily reality and as an imaginative resource suggesting some very fruitful couplings."⁶⁷ It is a fiction that expresses the heart of Haraway's program:

Cyborg imagery can help express two crucial arguments in this essay: first, the production of universal, totalizing theory is a major mistake that misses most of reality, probably always, but certainly now; and, second, taking responsibility for the social relations of science and technology means refusing an anti-science metaphysics, a demonology of technology, and so means embracing the skillful task of reconstructing the boundaries of daily life, in partial communication with others.⁶⁸

I take "fiction" here to mean "meaning" in addition to "story," for the total project in which Haraway is engaged is a refusal of instrumental reason. She wants to situate instrumentality within an explicitly meaningful and moral perspective. She writes:

We had better learn to think this nature, this common and shared place, as something other than a star wars test site or the New World Order, Inc. If technoscience is, among other things, a practice of materializing

⁶⁶ "Manifesto," p. 149; and "Introduction," in *Simians, Cyborgs, and Women*, (New York: Routledge, 1991), p. 1.

⁶⁷ "Manifesto," p. 150.

⁶⁸ "Manifesto," p. 181.

refigurations of what counts as nature, a practice of turning tropes into worlds, then how we figure technoscience makes an immense difference.⁶⁹

Haraway's deployment of "science fictions" is troubling however, particularly in relation to the cyborg. The cyborgs which populate Haraway's cosmology are almost all derived from science fiction—though even here there is some confusion. "We are all cyborgs," she so much as says. But the cyborgs she mostly seems to take pleasure in are those in the stories of science fiction writers. A distinction needs to be made. Though we all live in a world constructed by and suffused with technology, there are different levels at which this technology pervades and determines our forms of life. In other words, there are cyborgs and then there are cyborgs. Barney Clark is an example. As a dentist, technology had been central to his vocation, to his self-constituted identity. But as artificial heart recipient, he would literally be unable to survive without it. I make these two conditions visible not to oppose them as opposites, but to complicate what "cyborg" might mean.⁷⁰ Would this distinction make a difference for Haraway?

Does it matter that Haraway's cyborgs are derived from science fiction? I think so. Responsible commentators, those I have noted, find it very difficult to embrace the "cyborgity" of Barney Clark, an image produced by real science. And who wouldn't? Face flushed, physically incapacitated, his whole body vibrating heavily from the force of the Jarvik-7's pulses, Clark was a cyborg victim:

Clark's condition had stabilized. He slowly regained consciousness and was able to move his arms and legs. The next day he was pointing to his mouth, indicating that he wanted his teeth brushed. Physical therapists exercised Clark's arms and legs to prevent the muscles from atrophying. He was fed a gruel-like mixture through a tube inserted in his nostril and snaked down his throat into his stomach.⁷¹

I want to suggest that the cyborg, far from contesting the conditions of technoscience in the late twentieth century, is the perfect inscription of them. Instrumental reason reached its apex in the Jarvik-7 artificial heart: means without end, technol-

⁶⁹ "A Game of Cat's Cradle: Science Studies, Feminist Theory, Cultural Studies," *Configurations*, no. 1 (1994), p. 60.

⁷⁰ For a similar critique, see Marsha A. Hewitt, "Cyborgs, drag queens, and goddesses: Emancipatory-regressive paths in feminist theory," *Method and Theory in the Study of Religion*, no. 2 (1993), pp. 135-154.

⁷¹ A. Toufexis, "And the Beat Goes On," *Time*, Dec. 20 1982, p. 71.

ogy without trope. The Jarvik-7, in making material and real the instrumentalization of the body begun by William Harvey three hundred years earlier, effaced the very humanity of its subject and, by extension, of us all. In putting artificiality at the "heart" of the self, and by extension at the foundation of truth, the Jarvik-7 was another challenge of "artificiality and enlightenment."⁷² With less enthusiasm than Haraway, Reiser noted the importance of this challenge, the importance of meaning for the development and deployment of science. He also noted that it was William Harvey, who in making the heart a pump without purpose, bracketed ethical concern in the production of truth. Nature alone from then on was to direct science.

Yet, as many now appreciate, a balancing of scientific purpose and human purpose is necessary, just, and overdue. The dilemma is to bring human values and scientific methods into a relationship that damages the vital structure of neither. The artificial heart is an innovation that provides an important test of our ability to create such a balance.⁷³

In achieving that balance, an ethics of cyborgs is far more problematic than Haraway, lost in a world of science fiction, would admit. The horror of the experience of Barney Clark countermands any enthusiasm I could have for making people into cyborgs, even metaphorically. We have no first-person account of the experience of Clark. But psychologists recorded his mental condition throughout the experiment. I close with their observations:

[Clark said,] "My life is unpleasant like this and at times, I would rather be dead." By the third postoperative week, the patient's significant organic brain dysfunction was characterized by disorientation, fluctuating levels of alertness, profound intermediate and remote memory difficulties, a flat affect, irritability, and excellent but mainly delusional speech production. These episodes he related to the conviction that his "mind" was "shot" or that he would never "get better" physically. The patient experienced periods of despondency and asked to die or be killed.⁷⁴

⁷² "Artificiality," p. 250.

⁷³ "Machine," p. 169.

⁷⁴ C. K. Berenson and Bernard Grosser, "Total Artificial Heart Implantation," *Archives of General Psychiatry*, 41 (1984), p. 913.

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